Maryland Space Grant Consortium
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Maryland Space Grant Consortium is a Designated Consortium funded at a level of **$845,000** for fiscal year 2010.

PROGRAM GOALS

SCHOLARSHIPS AND FELLOWSHIP

GOAL I: To offer financial support to those higher education students enrolled in Maryland Institutions that wish to pursue a career in space-related STEM fields. Objective #1: The MDSG Scholarship Committee will continue to recruit qualified students for scholarships among the seven degree-granting institutions in the consortium, *viz*., JHU, MSU, UMCP, TU, UMES, UMBC, and HCC. Objective #2: The Scholarship Committee will continue to emphasize the recruitment of students from groups underrepresented in STEM disciplines. Objective #3: Continue to use the MDSGC Observatory, which is located on the roof of the Bloomberg Center for Physics & Astronomy on the Homewood campus of JHU, for student training and public outreach.

HIGHER EDUCATION

GOAL II: Provide Higher education students with opportunities to enhance their education in STEM areas and to promote their entry into aerospace related disciplines. Programs that provide relevant hands-on experience will be given high priority. Objective #1: Continue to support and enhance the MDSGC Balloon Payload Program (BPP) that provides students with access to near-space. Objective #2: Provide strong support to internships programs for undergraduate and graduate students on an ongoing basis, either through direct funding or through partnerships with organizations such as GSFC. Objective #3: Support a portfolio of programs that recruits students to STEM related studies and retains their interest to the point that it eventually carries over into

employment in STEM careers in general, and especially careers needed by NASA and the aerospace community. Objective #4: Continue to develop MDSGC capabilities and procedures to conduct longitudinal tracking of students who have received significant support from MDSGC, in order to determine the efficacy of our programs.

RESEARCH INFRASTRUCTURE
GOAL III: Support projects that provide opportunities for students to participate in aerospace-related research. Objective #1: Provide funding for programs that directly support students in gaining aerospace-related research experience. Objective #2: Ensure that research opportunities are made available to a diverse group of highly qualified students.

PRE-COLLEGE
GOAL IV: Support programs that provide substantive training to Maryland teachers that allow them to incorporate NASA-related content into effective teaching strategies. Objective #1: Facilitate the delivery of training that develops teacher's skills in the use of, and access to, earth and space science related data and discoveries, which will then inspire students to pursue careers in science, technology, engineering, and mathematics (STEM). Objective #2: Provide additional opportunities beyond the current earth and space science certification program for providing current content knowledge to in-service and pre-service teachers. Objective #3: Support programs that provide for hands-on, aerospace-related activities for middle school students.

INFORMAL SCIENCE
GOAL V: Increase the content knowledge of Maryland educators through training in informal science venues.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

Outcome 1: The MDSGC Scholarship Committee awarded scholarships to students with majors in STEM fields that relate to aerospace workforce needs. These scholarships were awarded at affiliate institutions of MDSGC. In all, 53 students were awarded scholarships in this program. Of the 53 students, 20 (38%) were female and 31 (58%) were underrepresented minorities. Additional fellowship/scholarship awards were made through competitive programs. A total of 64 students received fellowship and scholarship funds. Of these 64 students, 24 (37.5%) were female and 33 (47%) were underrepresented minorities.

Outcome 1: Competitive proposals to the MDSGC resulted in significant support for an additional 9 students in higher education projects where they received hands-on, real world experience. Of these, 6 (67%) were female and 2 (14%) were underrepresented minorities.

Outcome 1: A couple of quotes (out of many glowing comments received) from former participants in MDSGC higher education activities:

"I've entered into the MS degree program at the University of Maryland for a concentration in Space Propulsion and hoping to continue into the PhD program. (Jarred Young - on 08/24/10, 2009 MSIP)

"I've had the pleasure of interacting with the Maryland Space Grant for three different experiences: the NASA Academy internship, the Mars Desert Research Station mission (MDRS), and the AIAA international conference. These direct experiences have had several ripple effects on my career. Participating in the NASA Academy inspired me to apply for the NASA co-op program, which has opened doors for me and I hope to start working there full-time when I graduate. Several of the guest speakers I met during the Academy I've actually run into for various functions at Goddard and having that previous connection with them certainly helps. Also, having the NASA Academy experience on my resume made me more competitive when applying for scholarships and fellowships, which enabled me to continue on to graduate school, where I am now. For MDRS, being able to perform field-testing of our prototype hand tool led to our success at the regional student conference (1st place) and opened up the opportunity to participate in the international conference. Also, having this experience helped me in my application to attend the International Space University last summer, which enabled me to make connections with other young space professionals around the world who are likely to be the future leaders of the space community. (Heather Bradshaw - on 03/03/11, 2007 NASA Internship, 2007 NASA Academy, NASA GSFC - Graduate Co-op)"

Note that upon graduation with her MS in aerospace engineering in 2011 May, Bradshaw will begin working at GSFC.

Outcome 1: The MDSGC Balloon Payload Program continued its series of launches (31 to date). One student who served as the past team leader completed his master's degree in aerospace engineering and began work at SpaceX. His replacement as team leader is graduating with her BS in aerospace engineering and will be starting work on her master's degree in aerospace engineering.

Outcome 1: The University of Maryland College Park's senior design course participants submitted their prototype to the NASA RASC-AL competition, which they won for the third year in a row.

Outcome 1: A student exchange program was initiated for the summer of 2011, meeting an objective from our Augmentation Proposal. While the students have not been selected at the time of this report, they will be funded before the end of the current funding cycle. Two engineering students each from three affiliates (Morgan State University, University of MD College Park, and University of MD Eastern Shore) will work with mentors at one of the other institutions for the summer on NASA-related aerospace engineering research projects. This is based on a highly successful program conducted in 2009.

Outcome 2: The Earth & Space Science Teacher Certificate program, which is conducted in partnership with the Johns Hopkins University School of Education, continues with its current cohort of teachers, which is smaller than last year.

PROGRAM ACCOMPLISHMENTS

Outcome 1: 14 students took next step in FY10 (SG participation supported from FY06-FY10 funds)

- 7 are pursuing advanced degrees in STEM disciplines
- 2 accepted positions at NASA
- 2 accepted STEM positions in industry
- 1 accepted a STEM position in academia
- 2 went on to positions in non-STEM disciplines

Outcome 1: A major goal in our Augmentation Proposal was to support the efforts of Space Grant to foster closer ties with the Science Mission Directorate. The Assistant Director Co-Chairs a working group of the National Council of SG Directors that has this goal. MDSGC organized the effort of the working group to conduct a pilot program to place Space Grant interns at NASA missions that were not located at NASA Centers (since the Centers already have such a mechanism). This pilot program is underway. 21 students completed applications for research projects at Hubble Space Telescope, Chandra X-Ray Observatory, the NASA Astrobiology Institute (Penn State node), and the NASA Lunar Science Institute (Colorado node). The results of the experiment will be reported in 2012. Two students have been selected to work at the Chandra X-Ray Observatory on spacecraft engineering projects; one is attending school in Virginia and will be funded by the VASGC, while the other is attending school in Pennsylvania and will be funded by MDSGC. The NASA Astrobiology Institute at Penn State will host one student, to be paid for by PASGC. The NASA Lunar Science Institute in Colorado will host two students; one is attending North Carolina State University and will be supported by NCSGC and the other is from Montana and will be paid for by the MTSGC. The HST internship has not been filled at this time, but applications are in progress.

Outcome 3: MDSGC met Goal V of its baseline proposal, "Increase the content knowledge of Maryland educators through training in informal science venues", by working with the Maryland Academy of Sciences to conduct AstroNight at the Maryland Science Center (MSC). Over 100 teachers from all parts of Maryland came to MSC for a weekend of professional development on NASA-related content and ways to use this content in the Maryland classroom. This included a "camp-in" on Saturday night in the Science Center. Separate tracks were provided to ensure that material was presented that was relevant to the grade levels that the educators taught. Final evaluation of this program will not be complete until planned follow-up interviews with the participants reveal how successful they were in implementing this material in their classroom, but the end of activity surveys indicated almost universal and enthusiastic responses from the participants.

NASA 2010 Education Priorities

- Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

MDSGC sponsors research internships at NASA Centers that are all hands-on science and engineering projects. In the summer of 2011 MDSGC sponsored two students at GSFC, one at GRC, and two at LRC (through the LARSS program).

Students are also being supported to participate in our student exchange program. In this program two engineering students from each of three affiliates are sent to one of the other affiliates to work on a NASA-related research project for the summer. This summer the projects are: Reliability & Risk Analysis through Novel Use of Multi-modal Design, Failure and On-Orbit Data; Dual Mode Resonator Filters for Cognitive & Software Defined Radio Technologies; StratoPigeon 1 payload for HASP; Human-robot Interactions for Space Operations; Aerial Imaging Using Kite and Weather Balloon Platforms; and Refining AQUABOT for remote/autonomous control and water quality data gathering and Mapping.

The MDSGC Balloon Payload Program continues with regular launches. The construction, launch, recovery, and data analysis for payloads launched on a weather balloon has been an integral part of the curriculum for freshman aerospace engineers at University of Maryland College Park, with support from MDSGC. The BPP team is also focused on advanced payloads that they have successfully obtained flight berths on NASA HASP balloon flights for the past several years, and are working on a payload for the upcoming flight.

A number of student experiences were also provided by programs that were funded through the MDSGC grant process. These included students who conducted research at the Desert Research Station, students who worked with GSFC engineers on risk and reliability assessment tools, a student working on an autonomous robot for collecting water quality data on the Chesapeake Bay, and students working on low-cost aerial imaging for precision agriculture studies.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

An informal science project involved over 100 teachers in a two-day workshop at the Maryland Science Center. The activity included a number of middle school teachers, and was focused on updating their content knowledge about current NASA space science research, and useful NASA-generated activities that they could use in the classroom.

MDSGC, working in partnership with the Johns Hopkins University School of Education, provides support for Maryland teachers to take a series of courses that lead to a certificate in earth & space science. Active efforts to recruit teachers have led to reaching our goal of 15 teachers in the current cohort.

- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.

The United States Naval Academy conducted a summer camp for middle school girls to expose them to engineering. Research assistants are hired for the summer, and a significant part of their work is to support the camp and serve as mentors to the girls who are participating. MDSGC supported one undergraduate and three high school students to serve as mentors for this program. These mentors serve as examples to the students throughout the pipeline in engineering all the way to the female faculty who operate the program.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

Hagerstown Community College is an affiliate of MDSGC and anchors much of our efforts in the Western Maryland panhandle. They are active participants in all MDSGC activities and programs. They receive scholarships and are regularly successful in proposals for projects.

Capitol College was awarded a small grant to support its Emerging STEM Leaders Program. This project brought students from Prince Georges Community College and the Community College of Baltimore County to the Capitol College campus. The main goal of the workshops was to strengthen the interest and provide information to students from underrepresented groups about STEM majors and careers. Topics included robotics, spacecraft operations, and cybersecurity. Keynote speakers from NASA, industry, and academia were a part of each workshop.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

One of the research infrastructure awards made in 2010 was to the University of Maryland Eastern Shore. This is a follow-on to a previous grant. Students worked to design a low-cost remote controlled boat that collects water samples in the Chesapeake Bay. The new grant will have the students work on improving the performance of this robot craft, Aquabot, and making its operation more autonomous.

- Diversity of institutions, faculty, and student participants.

Two of the ten affiliates (20%) of the MDSGC are HBCUs. Our practice is to have affiliate members who are very actively engaged in the work of MDSGC, participating in its programs, and receiving student scholarship funds, as is the case for University of Maryland Eastern Shore and Morgan State University.

There were 19 faculty that participated in the funded proposals. Of those, 12 (63%) were female, and 3 (16%) were underrepresented.

As noted above, of the 64 students who received fellowship/scholarship funds at a significant level, 37.5% were female and 47% were underrepresented minorities.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking: Student Data and Longitudinal Tracking: Total awards = 73; Fellowship/Scholarship = 64, Higher Education/Research Infrastructure = 0; 47% of the total award represent underrepresented minority F/S funding. During the FY10 program year14 students advanced to the next level: 7 are pursuing advanced degrees in STEM disciplines, 2 accepted positions at NASA, 2 accepted STEM positions in industry, 1 accepted a STEM position in academia, and 2 went on to positions in non-STEM disciplines. This represents an increase over last year, due to the increased funding level available to MDSGC in 2010-2011.

  In addition, for all students that were significantly supported in the period spanning FY06-FY10, 20 are pursuing advanced degrees in STEM disciplines, 6 accepted STEM positions at NASA contractors, 4 accepted positions at NASA, 8 accepted STEM positions in industry, 4 accepted STEM positions in academia, and 5 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing while the received their Space Grant award.

- Course Development: No new courses were established in 2010, however, continued support of the Balloon Payload Program has continued to make student launches an integral part of the freshman aerospace engineering curriculum at the University of Maryland College Park. In addition, MDSGC has continued to support the senior capstone design course in aerospace engineering (ENAE 483/484) at UMCP.

- Matching Funds: In 2010 MDSGC is projected to receive $757,555 in non-federal matching funds.

- Minority-Serving Institutions: Two of the ten members of MDSGC are HBCUs. They are both fully engaged members of MDSGC, as are all affiliates. The University of Maryland Eastern Shore successfully proposed for an extension of two research infrastructures projects: Using remote sensing for precision agriculture and using robotic water craft to sample water pollution in the Chesapeake Bay. Morgan State University continued to be a regular contributor to the Balloon Payload Program. Morgan State also received funding, based on successful proposals, to

continue their work placing students at GSFC and to enhance their NASA-funded systems engineering program.

IMPROVEMENTS MADE IN THE PAST YEAR

The Earth & Space Science Teacher Certificate Program was reviewed and the content updated. The participants' experience was enhanced by the addition of guest lectures by experts in the field on the latest developments. These experts were recruited from Space Telescope Science Institute, Johns Hopkins University, and GSFC.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Johns Hopkins University – Lead Institution
Hagerstown Community College
Johns Hopkins University Applied Physics Laboratory
Morgan State University
Space Telescope Science Institute
Towson University
United States Naval Academy
University of Maryland Baltimore County
University of Maryland College Park
University of Maryland Eastern Shore

All members are actively involved with MDSGC. Each institution has a member on the Program Committee, which reviews proposals for funding and advises the program. The Program Committee meets 4-5 times per year. Each institution provides a senior staff member who serves on the Oversight Committee, which meets annually with the Director to review the program. Scholarships are provided to students at JHU, HCC, MSU, TU, UMBC, UMCP, and UMES, all of which have one or more members on the Scholarship Committee who are actively engaged in recruiting and selecting students.